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United States
Department of
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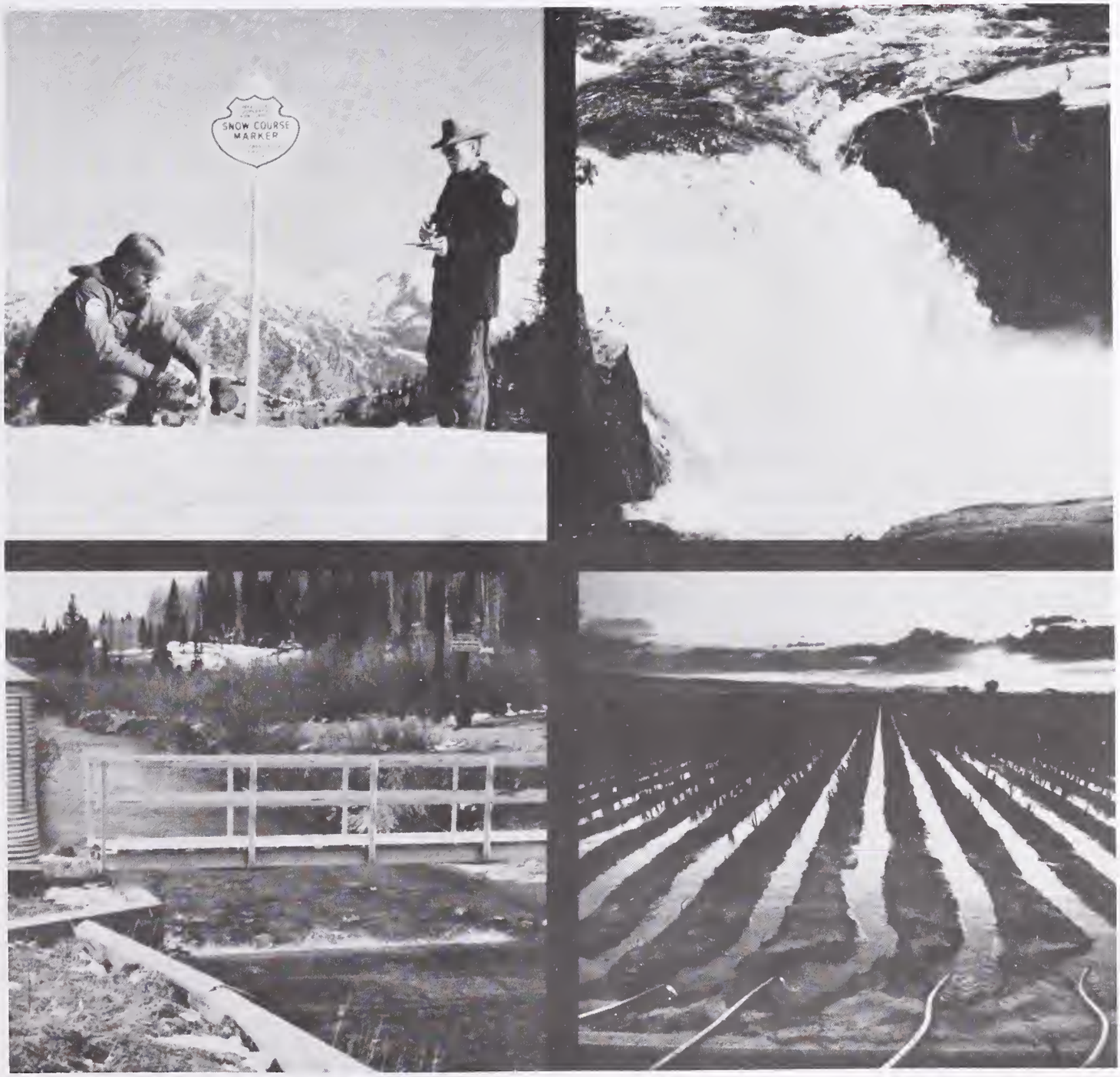
**Soil
Conservation
Service**

**Bozeman,
Montana**

Montana Water Supply Outlook

October 1, 1988



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Foreword

How Forecasts Are Made

Most of the annual streamflow in the Western United States originates as snowfall. This snowfall accumulates high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are viewed in conjunction with snowpack data to prepare runoff forecasts. This report presents a comprehensive picture of water supply outlook conditions for areas dependent upon surface runoff. It includes selected streamflow forecasts, summarized snowpack and precipitation data, reservoir storage data and narratives describing current conditions.

Streamflow forecasts are cooperatively generated by Soil Conservation Service and National Weather Service hydrologists. Forecasts become more accurate as more data affecting runoff becomes known. For this reason, forecasts are issued that reflect three future precipitation conditions — Below Normal, Average, and Above Normal. These forecasts are terms reasonable minimum, most probable, and reasonable maximum. Actual streamflow can be expected to fall between the lower and upper forecast values eight out of ten years.

Snowpack data are obtained by using a combination of manual and automated measurement methods. Manual readings of snow depth and water equivalent are taken at locations called snow courses on a monthly or semi-monthly schedule during the winter. In addition, snow water equivalent, precipitation, temperature, and other parameters are monitored on a daily basis and transmitted via radio telemetry to central data collection facilities. Both monthly and daily data are used to project snowmelt runoff.

For More Information

Copies of Monthly Water Supply Outlook Reports and other reports may be obtained from the states listed below. An annual snow survey data summary is published by the Soil Conservation Service for each of the western states. Historical snow survey data may be obtained at those same offices.

STATE	ADDRESS
Alaska	201 East 9th Ave., Suite 300, Anchorage, AK 99501-3687
Arizona	201 East Indianola, Suite 200, Phoenix, AZ 85012
Colorado	2490 West 26th Ave., Denver, CO 80211
New Mexico	517 Gold Ave. S.W., Room 3301, Albuquerque, NM 87102-3157
Idaho	304 North 8th Street, Room 345, Boise, ID 83702
Montana	10 East Babcock, Room 443, Federal Building, Bozeman, MT 59715
Nevada	1201 Terminal Way, Room 219, Reno, NV 89502
Oregon	1220 Southwest 3rd Ave., Room 1640, Portland, OR 97204
Utah	4402 Federal Building, 125 South State Street, Salt Lake City, UT 84147
Washington	360 U.S. Court House, Spokane, WA 99201-1080
Wyoming	Federal Building, 100 East "B" Street, Casper, WY 82601

In addition to state reports, a Water Supply Outlook for the Western United States is published by the Soil Conservation Service and National Weather Service monthly, January through May. Reports may be obtained from the Soil Conservation Service, West National Technical Center, 511 Northwest Broadway, Room 248, Portland, OR 97209.

Published by other agencies:

Water Supply Outlook Reports prepared by other agencies include: California — Snow Survey Branch, California Department of Water Resouces, P.O. Box 388, Sacramento, CA 95802; British Columbia — The Ministry of Environment, Water Investigations Branch, Parliament Buildings, Victoria, British Columbia, V8V 1X5; Yukon Territory — Department of Indian and Northern Affairs, Northern Operations Branch, 200 Range Road, Whitehorse, Yukon Territory, Y1A 3V1; Alberta, Environment Technical Services Division, 9820 106th St., Edmonton, Alberta T5K 2J6.

Montana
Water Supply Outlook

and

Federal – State – Private
Cooperative Snow Surveys

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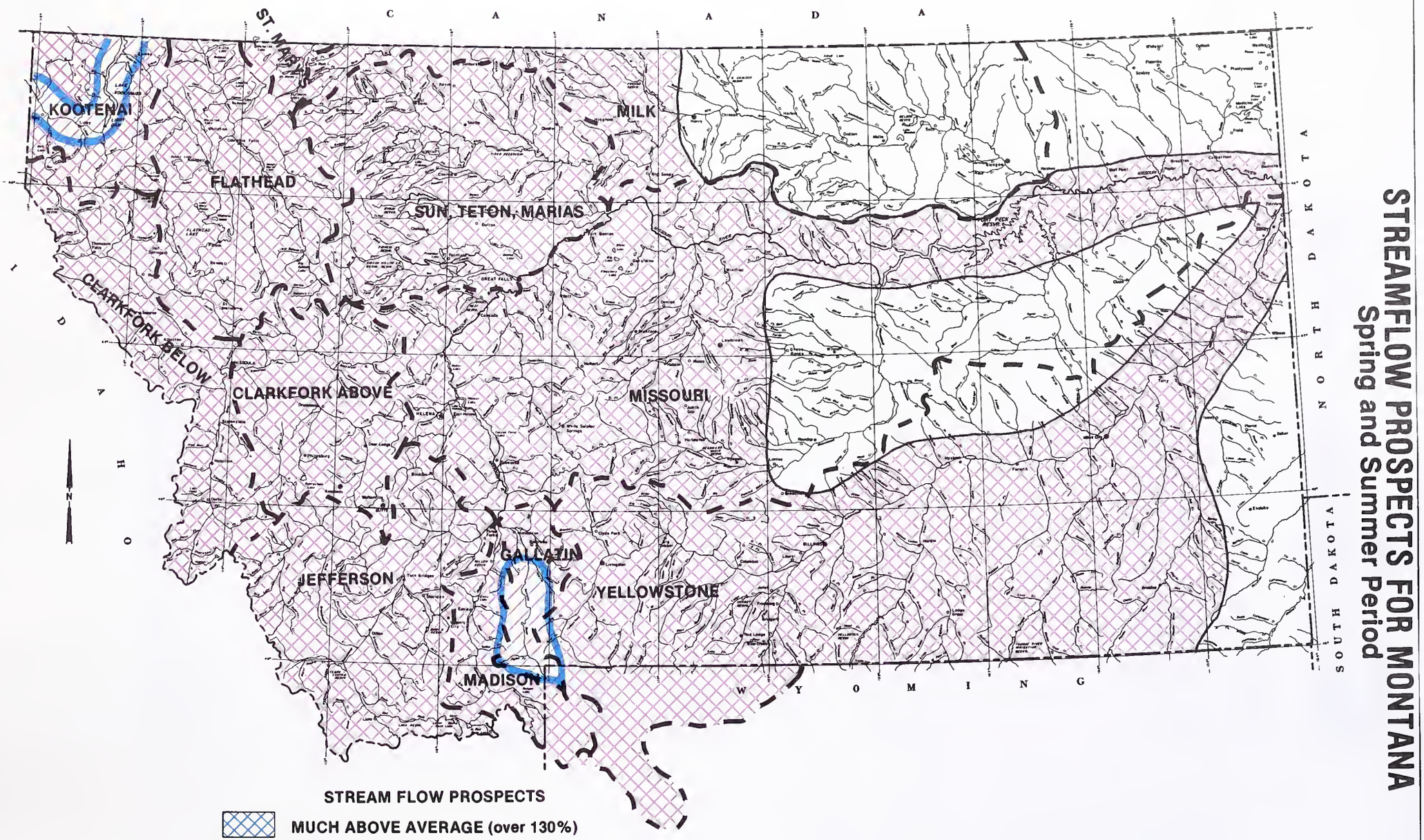
U.S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

STREAMFLOW PROSPECTS FOR MONTANA
Spring and Summer Period



STREAM FLOW PROSPECTS

- MUCH ABOVE AVERAGE (over 130%)
- ABOVE AVERAGE (110-130%)
- NEAR AVERAGE (90-110%)
- BELOW AVERAGE (70-90%)
- MUCH BELOW AVERAGE (below 70%)
- NOT FORECAST

Provisional 1988 April-September Runoff

0 25 50 75 100 MI

0 50 100 150 KM

SOURCE:
Information provided by SCS Snow Survey Personnel.

JUNE 1985 4-R-39296

General Outlook

Summary

The year started off dry. Snow accumulation started late on dry soils. Winter snowfall was below average and melt started early. Precipitation was very low and summer temperatures were generally above average. Streamflows were well below average and many streams were dried up by diversions. Most irrigation reservoir storage was depleted. Fires burned large portions of some watersheds. The only real bright spot occurred after mid-September when rain and snow fell over most watersheds. Only time will tell if this is a change toward more favorable weather patterns or just a temporary respite. Next year's water supply is very dependent on how much moisture is replaced in the mountain soils before snowfall, how much snow falls this winter and how favorable are next year's spring rains.

Snowpack

Snow accumulation started late and fell on dry soil. Most areas did not show any significant accumulation until mid-November. Below average snowfall continued until March in most basins. March and April showed near to above average snowfall but it was a case of too little-too late. By peak accumulation, nearly all areas had less than 80 percent of average snowpack. Melt started around mid-April and snowpack levels continued to decline. By May 1, the water content of the snowpack was less than 70 percent of average over the majority of the State. Snow continued to melt and most areas were bare by June 1. This is two to three weeks earlier than normal.

Precipitation

The fall started off dry. Very little moisture fell before snow accumulation leaving mountain soils dry going into the winter. This below average precipitation pattern persisted over most of the State through February. Mountain precipitation in March and April was near or above average in most basins. Precipitation continued this below average trend over most of the State until mid-September. During the last half of September, some mountain ranges in central Montana and along the Continental Divide from Homestake Pass to Marias Pass received a good moisture combination of snow and rain while other areas received less moisture.

Reservoirs

Last winter's low streamflows, below average spring runoff and above average irrigation demands precluded the filling of some irrigation reservoirs. Some large multipurpose reservoirs did not fill either. Heavy irrigation demands reduced storage levels to empty or near empty in many reservoirs. Unless fall moisture is well above average, most will stay at below average levels until next spring's runoff.

Streamflow

With the lack of fall moisture, most soils were dry going into the winter and streamflows were below average through the winter months. With earlier than normal snowmelt, most streams recorded average or above average runoff in April. Except for the Gallatin and Yellowstone Rivers, May runoff was below average. With deficient snowpacks and lack of summer rains, streamflows dropped to well below average levels. New record low daily flows were recorded at some stations. Many streams were dewatered by irrigation diversions. Low flows are expected to continue through the winter months unless fall moisture is adequate to recharge the extremely dry soils prior to snow accumulation.

Fires Affect Snow Sites

The extensive fires destroyed some snow measuring sites and altered the hydrologic character of many watersheds. Three SNOTEL sites were destroyed. Black Pine, near Philipsburg, will be relocated this fall and should be operational by mid-October. Black Bear, near the Wyoming-Idaho-Montana border south of West Yellowstone and west of Yellowstone National Park, will be relocated this fall. Wolverine, in the Clark's Fork River Drainage and east of Yellowstone Park in Wyoming, will be reinstalled at the burned out location. Some snow courses were also destroyed by fire. Every effort will be made to relocate these sites before winter. Burned portions of watersheds are being evaluated to estimate the increased runoff that will be generated and the effect on and timing of peak snowmelt runoff. Increases in sediment load is inevitable but no attempts are presently planned to quantify these amounts. Anyone having questions relating to the effects of these fires on the snow survey and water supply forecasting programs of the Soil Conservation Service should contact your local SCS office.

Mining disturbs Ten Mile Upper Snow Course

The Ten Mile Upper snow course near Helena was partially destroyed by mining activity. Part of the course was relocated and prior records adjusted to reflect current conditions. The back records in the Centralized Forecast System database have been adjusted. The data is available to those using this snow course for forecasting. Check with the snow survey office in Bozeman if you need a conversion from the new course to the old course or if you have any questions.

1988 SNOW COVER COMPARISONS

(as a percent of average)

RIVER BASIN and/or SUB-WATERSHED	JAN 1	FEB 1	MAR 1	APR 1	MAY 1
COLUMBIA RIVER DRAINAGE					
Kootenai	53	56	59	70	59
Flathead	52	59	65	76	59
Upper Clark Fork	55	64	73	75	62
Lower Clark Fork	53	58	66	74	58
Bitterroot	63	71	80	84	65
MISSOURI RIVER DRAINAGE					
Jefferson	61	67	71	74	61
Madison	61	69	72	74	64
Gallatin	50	63	70	79	68
Missouri Main Stem	46	60	72	77	69
Judith-Musselshell	37	61	71	80	71
Sun-Teton-Marias	50	60	66	79	62
Milk	35	53	60	70	40
YELLOWSTONE RIVER DRAINAGE					
Yellowstone (above Bighorn)	43	58	68	74	68
Bighorn	64	65	73	81	73
Little Big Horn	68	78	83	91	87
Tongue	70	72	82	94	77
Powder	59	63	77	87	67
SASKATCHEWAN RIVER DRAINAGE					
St. Mary	40	52	56	72	57

MOUNTAIN PRECIPITATION

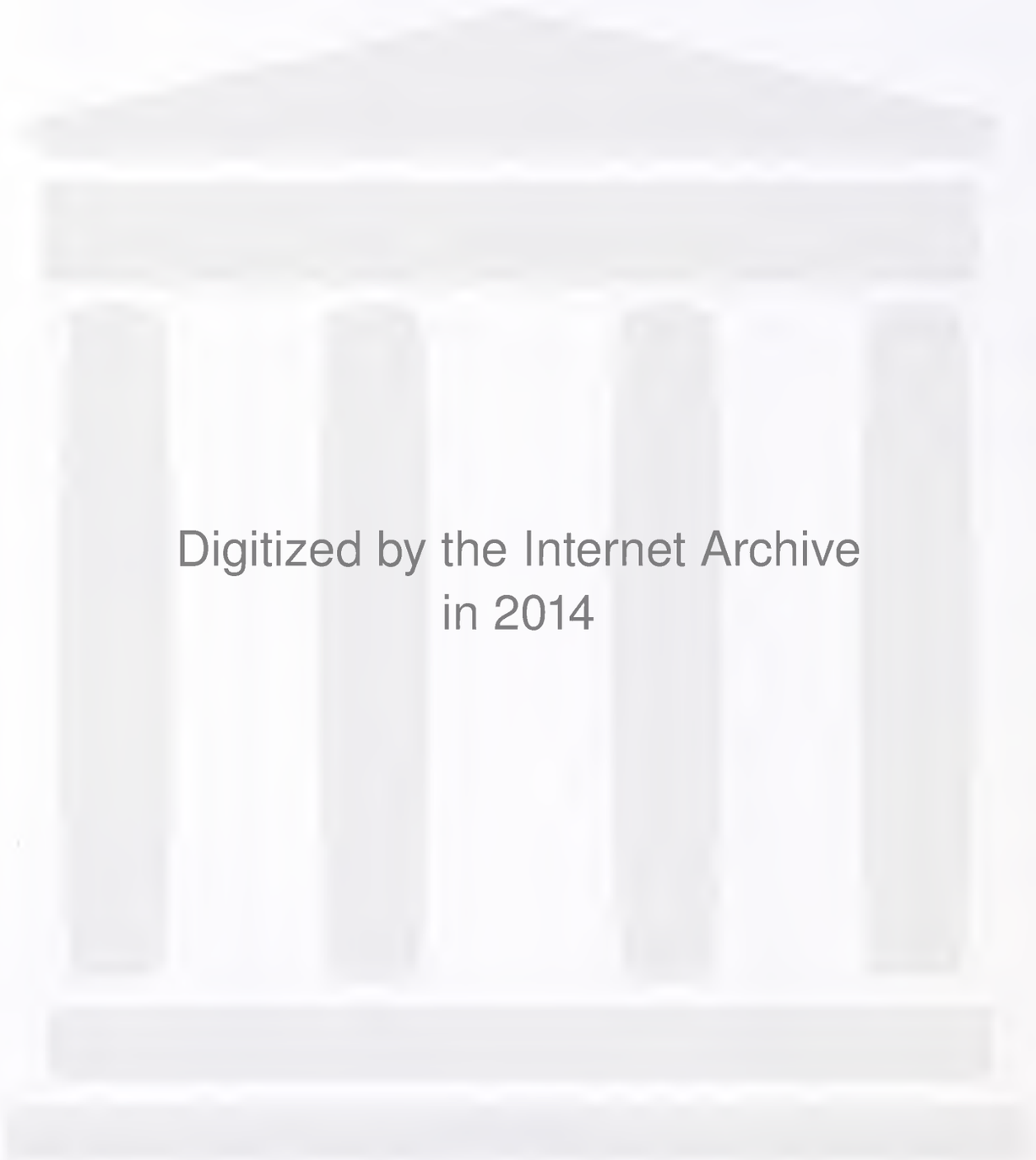
1988 Water Year

PERCENT OF AVERAGE BY BASIN

	JUNE	JULY	AUG	SEPT	WATER YEAR OCT 1 THRU SEPT 30
KOOTEANI	67	59	26	93	74
FLATHEAD	71	61	25	89	75
CLARK FORK (ABOVE)	63	30	10	88	74
CLARK FORK (BELOW)	64	50	30	56	78
JEFFERSON	47	21	31	77	73
MADISON	47	26	26	50	63
GALLATIN	41	24	19	38	67
MISSOURI	51	52	23	92	77
SUN-TETON-MARIAS	63	40	26	89	71
ST. MARY/MILK	74	89	18	83	72
YELLOWSTONE	40	30	15	36	70

RESERVOIR STORAGE (Thousand Acre-Feet) End of Month September 30, 1988

BASIN OR STREAM	RESERVOIR	USEABLE CAPACITY	USEABLE STORAGE THIS YEAR	LAST YEAR	AVERAGE
	COLUMBIA				
Kootenai	Koocanusa	5,748.2	4,223.0	5,126.0	5,164.0
Flathead	Hungry Horse	3,451.0	1,694.0	2,995.0	3,189.0
	Flathead Lake	1,791.0	1,690.0	1,761.0	1,735.0
	Camas (4)	45.2	6.2	20.8	18.1
	Mission Valley (8)	100.3	6.6	23.3	26.8
Clark Fork	Georgetown Lake	31.0	25.0	30.5	28.3
	Lower Willow Creek	4.9	0.3	0.9	0.9
	Nevada Creek	12.6	0.2	---	4.0
	Noxon Rapids	334.6	318.3	324.4	326.4
Bitterroot	Painted Rocks	31.7	---	---	22.6
	Como	34.9	---	2.4	2.5
	MISSOURI				
Beaverhead	Lima	84.0	5.1	23.6	30.0
	Clark Canyon	255.6	76.2	137.7	120.6
Ruby	Ruby	38.8	---	11.4	11.8
Madison	Hebgen Lake	377.5	314.4	349.6	336.5
	Ennis Lake	41.0	36.7	37.3	36.7
Gallatin	Middle Creek	8.0	3.0	3.9	3.1
Missouri	Canyon Ferry	2,043.0	1,406.0	1,734.0	1,748.0
	Hauser & Helena	61.9	63.1	63.0	58.9
	Helena Valley	9.2	6.8	6.5	6.9
	Lake Helena	10.4	10.9	10.9	10.4
	Holter Lake	81.9	81.4	81.0	77.8
	Fort Peck Lake	18,910.0	13,700.0	15,960.0	16,090.0
Smith	Smith River	10.6	0.3	7.8	5.6
	Newlan Creek	12.4	0.2	11.3	10.1
Musselshell	Bair	7.0	0.0	5.7	3.2
	Martinsdale	23.1	0.2	12.0	9.7
	Deadman's Basin	72.2	7.5	---	35.4
Sun	Gibson	99.1	6.6	30.0	29.1
	Willow Creek	32.2	7.1	25.0	19.4
	Pishkun	32.0	11.1	5.8	16.7
Marias	Lower Two Medicine	11.9	8.1	---	4.6
	Four Horns	19.2	8.6	---	11.6
	Swift	30.0	6.2	10.0	11.9
	Lake Frances	111.9	45.2	74.4	71.2
	Elwell (Tiber)	1,347.0	676.2	807.8	606.7
Milk	Beaver Creek	3.5	0.4	3.1	2.1
	Fresno	127.2	15.8	67.8	67.6
	Nelson	66.8	5.6	54.3	42.2
	HUDSON BAY				
St. Mary's	Lake Sherburne	64.8	6.6	21.9	7.6
	YELLOWSTONE				
Stillwater	Mystic Lake	21.0	19.9	18.6	19.5
Clark's Fork	Cooney	27.4	11.0	16.5	13.2
Tongue	Tongue River	68.0	21.9	16.1	24.8
Bighorn	Bighorn Lake	1,356.0	793.3	1,025.0	749.0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The Following Organizations Cooperate With The Soil Conservation Service In Snow Survey Work

Canadian

Department of the Environment
- Atmospheric Environment Service
- Water Management Service

British Columbia Ministry of Environment
- Inventory and Engineering Branch, Hydrology Section

Alberta Environment
- Technical Services Division

Federal

U.S. Department of Agriculture
- Forest Service

U.S. Department of the Army
- Corps of Engineers

U.S. Department of Commerce
- NOAA, National Weather Service
- National Environmental Satellite Service

U.S. Department of the Interior
- Bureau of Indian Affairs
- Fish and Wildlife Service
- Geological Survey
- National Park Service
- Bureau of Reclamation

U.S. Department of Energy
- Bonneville Power Administration

State

Montana Conservation Districts
Montana Department of Fish, Wildlife, and Parks
Montana Department of Natural Resources and Conservation
Montana Department of State Lands
Montana State University - Agricultural Experiment Station
University of Montana - School of Forestry

Private

Big Sky of Montana
Butte Water Company
Confererated Salish & Kootenai Tribes
Flathead Valley Comminity College
Montana Power Company
Pondera County Canal & Reservoir Company

Other organizations and individuals furnish information for the snow survey reports.
Their cooperation is gratefully acknowledged.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SNOW SURVEY UNIT
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Bozeman, MT 59715

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